

February 1988

## MM54C901/MM74C901 Hex Inverting TTL Buffer MM54C902/MM74C902 Hex Non-Inverting TTL Buffer MM54C903/MM74C903 Hex Inverting CMOS Buffer MM54C904/MM74C904 Hex Non-Inverting CMOS Buffer

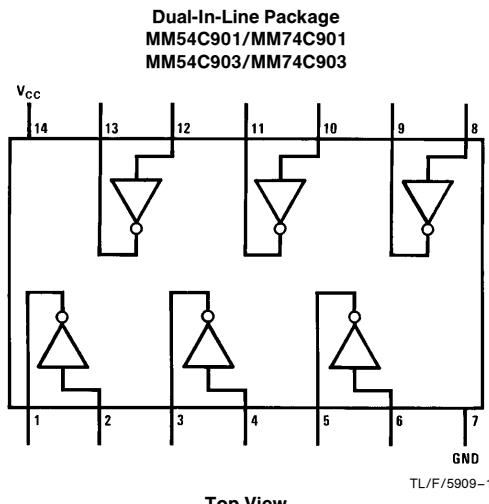
### General Description

These hex buffers employ complementary MOS to achieve wide supply operating range, low power consumption, and high noise immunity. These buffers provide direct interface from PMOS into CMOS or TTL and direct interface from CMOS to TTL or CMOS operating at a reduced  $V_{CC}$  supply.

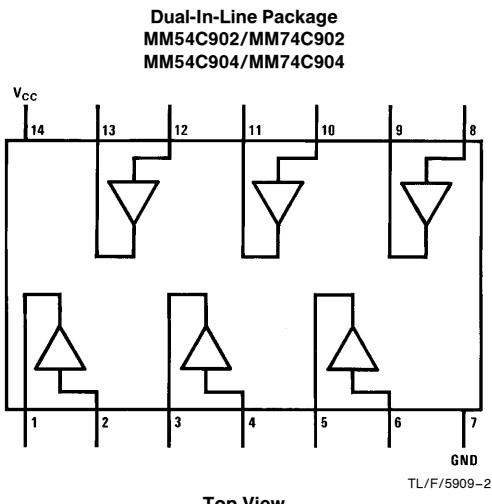
### Features

- Wide supply voltage range 3.0V to 15V
- Guaranteed noise margin 1.0V
- High noise immunity 0.45  $V_{CC}$  (typ.)
- TTL compatibility Fan out of 2 driving standard TTL

### Connection Diagrams



Order Number MM54C901,  
MM74C901, MM54C903 or MM74C903



Order Number MM54C902,  
MM74C902, MM54C904 or MM74C904

**MM54C901/MM74C901 (TTL), MM54C903/MM74C903 (CMOS) Hex Inverting Buffer  
MM54C902/MM74C902 (TTL), MM54C904/MM74C904 (CMOS) Hex Non-Inverting Buffer**

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at Any Pin  $-0.3V$  to  $V_{CC} + 0.3V$

Voltage at Any Input Pin

MM54C901/MM74C901  $-0.3V$  to  $+15V$

MM54C902/MM74C902  $-0.3V$  to  $+15V$

MM54C903/MM74C903  $V_{CC} - 17V$  to  $V_{CC} + 0.3V$

MM54C904/MM74C904  $V_{CC} - 17V$  to  $V_{CC} + 0.3V$

Storage Temperature Range ( $T_S$ )  $-65^{\circ}C$  to  $+150^{\circ}C$

Power Dissipation ( $P_D$ )

Dual-In-Line  $700\text{ mW}$

Small Outline  $500\text{ mW}$

Operating Temperature Range ( $T_A$ )

MM54C901, MM54C902,

MM54C903, MM54C904

$-55^{\circ}C$  to  $+125^{\circ}C$

MM74C901, MM74C902,

MM74C903, MM74C904

$-40^{\circ}C$  to  $+85^{\circ}C$

Operating  $V_{CC}$  Range

$3.0V$  to  $15V$

Absolute Maximum  $V_{CC}$

$18V$

Lead Temperature ( $T_L$ )

(Soldering, 10 seconds)

$260^{\circ}C$

DC Electrical Characteristics Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CMOS TO CMOS</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5.0V, I_O = -10\text{ }\mu A$ $V_{CC} = 10V, I_O = -10\text{ }\mu A$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5.0V$ $V_{CC} = 10V$			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1.0	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		$\mu A$
$I_{CC}$	Supply Current	$V_{CC} = 15V$		0.05	15	$\mu A$
<b>TTL TO CMOS</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	54C $V_{CC} = 4.5V$ 74C $V_{CC} = 4.75V$	$V_{CC} - 1.5$ $V_{CC} - 1.5$			V V
$V_{IN(0)}$	Logical "0" Input Voltage	54C $V_{CC} = 4.5V$ 74C $V_{CC} = 4.75V$			0.8 0.8	V V
<b>CMOS TO TTL</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	MM54C901, MM54C903 MM54C902, MM54C904 MM74C901, MM74C903 MM74C902, MM74C904	$V_{CC} = 4.5V$ $V_{CC} = 4.5V$ $V_{CC} = 4.75V$ $V_{CC} = 4.75V$	4.0 $V_{CC} - 1.5$ 4.25 $V_{CC} - 1.5$		V V V V
$V_{IN(0)}$	Logical "0" Input Voltage	MM54C901, MM54C903 MM54C902, MM54C904 MM74C901, MM74C903 MM74C902, MM74C904	$V_{CC} = 4.5V$ $V_{CC} = 4.5V$ $V_{CC} = 4.75V$ $V_{CC} = 4.75V$		1.0 1.5 1.0 1.5	V V V V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C $V_{CC} = 4.5V, I_O = -800\text{ }\mu A$ 74C $V_{CC} = 4.75V, I_O = -800\text{ }\mu A$	2.4 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	MM54C901, MM54C903 MM54C902, MM54C904 MM74C901, MM74C903 MM74C902, MM74C904	$V_{CC} = 4.5V, I_O = 2.6\text{ mA}$ $V_{CC} = 4.5V, I_O = 3.2\text{ mA}$ $V_{CC} = 4.75V, I_O = 2.6\text{ mA}$ $V_{CC} = 4.75V, I_O = 3.2\text{ mA}$		0.4 0.4 0.4 0.4	V V V V

## DC Electrical Characteristics (Continued)

Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OUTPUT DRIVE (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)</b> <b>(MM54C901/MM74C901, MM54C903/MM74C903)</b>						
I <sub>SOURCE</sub>	Output Source Current (P-Channel)	V <sub>CC</sub> = 5.0V, V <sub>OUT</sub> = 0V T <sub>A</sub> = 25°C, V <sub>IN</sub> = 0V	-5.0			mA
I <sub>SOURCE</sub>	Output Source Current (P-Channel)	V <sub>CC</sub> = 10V, V <sub>OUT</sub> = 0V T <sub>A</sub> = 25°C, V <sub>IN</sub> = 0V	-20			mA
I <sub>SINK</sub>	Output Sink Current (N-Channel)	V <sub>CC</sub> = 5.0V, V <sub>OUT</sub> = V <sub>CC</sub> T <sub>A</sub> = 25°C, V <sub>IN</sub> = V <sub>CC</sub>	9.0			mA
I <sub>SINK</sub>	Output Sink Current (N-Channel)	V <sub>CC</sub> = 5.0V, V <sub>OUT</sub> = 0.4V T <sub>A</sub> = 25°C, V <sub>IN</sub> = V <sub>CC</sub>	3.8			mA
<b>(MM54C902/MM74C902, MM54C904/MM74C904)</b>						
I <sub>SOURCE</sub>	Output Source Current (P-Channel)	V <sub>CC</sub> = 5.0V, V <sub>OUT</sub> = 0V T <sub>A</sub> = 25°C, V <sub>IN</sub> = V <sub>CC</sub>	-5.0			mA
I <sub>SOURCE</sub>	Output Source Current (P-Channel)	V <sub>CC</sub> = 10V, V <sub>OUT</sub> = 0V T <sub>A</sub> = 25°C, V <sub>IN</sub> = V <sub>CC</sub>	-20			mA
I <sub>SINK</sub>	Output Sink Current (N-Channel)	V <sub>CC</sub> = 5.0V, V <sub>OUT</sub> = V <sub>CC</sub> T <sub>A</sub> = 25°C, V <sub>IN</sub> = 0V	9.0			mA
I <sub>SINK</sub>	Output Sink Current (N-Channel)	V <sub>CC</sub> = 5.0V, V <sub>OUT</sub> = 0.4V T <sub>A</sub> = 25°C, V <sub>IN</sub> = 0V	3.8			mA

## AC Electrical Characteristics\* T<sub>A</sub> = 25°C, C<sub>L</sub> = 50 pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>MM54C901/MM74C901, MM54C903/MM74C903</b>						
t <sub>pd1</sub>	Propagation Delay Time to a Logical "1"	V <sub>CC</sub> = 5.0V V <sub>CC</sub> = 10V	38 22	70 30		ns
t <sub>pd0</sub>	Propagation Delay Time to a Logical "0"	V <sub>CC</sub> = 5.0V V <sub>CC</sub> = 10V	21 13	35 20		ns
C <sub>IN</sub>	Input Capacitance	Any Input (Note 2)		14		pF
C <sub>PD</sub>	Power Dissipation Capacity	(Note 3) Per Buffer		30		pF
<b>MM54C902/MM74C902, MM54C904/MM74C904</b>						
t <sub>pd1</sub>	Propagation Delay Time to a Logical "1"	V <sub>CC</sub> = 5.0V V <sub>CC</sub> = 10V	57 27	90 40		ns
t <sub>pd0</sub>	Propagation Delay Time to a Logical "0"	V <sub>CC</sub> = 5.0V V <sub>CC</sub> = 10V	54 25	90 40		ns
C <sub>IN</sub>	Input Capacitance	Any Input (Note 2)		5.0		pF
C <sub>PD</sub>	Power Dissipation Capacity	(Note 3) Per Buffer		50		pF

\*AC Parameters are guaranteed by DC correlated testing.

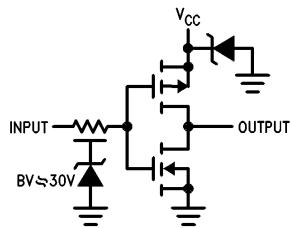
**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Capacitance is guaranteed by periodic testing.

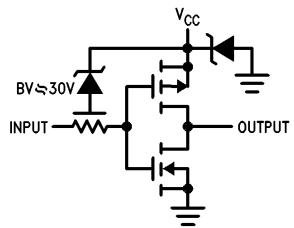
**Note 3:** C<sub>PD</sub> determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note AN-90.

## Logic Diagrams

**MM54C901/MM74C901**  
CMOS to TTL Inverting Buffer



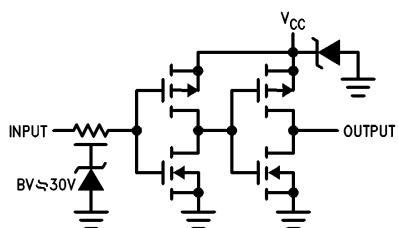
**MM54C903/MM74C903**  
PMOS to TTL or CMOS Inverting Buffer



TL/F/5909-3

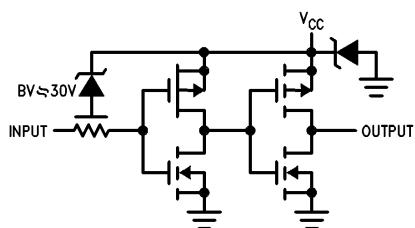
TL/F/5909-4

**MM54C902/MM74C902**  
CMOS to TTL Buffer



TL/F/5909-5

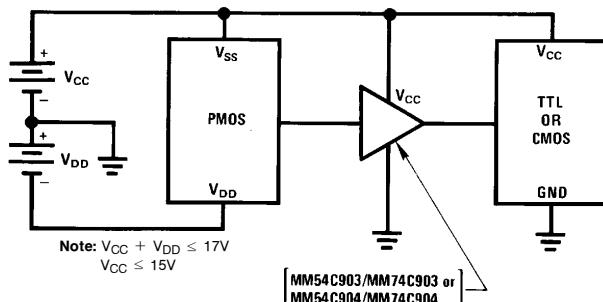
**MM54C904/MM74C904**  
PMOS to TTL or CMOS Buffer



TL/F/5909-6

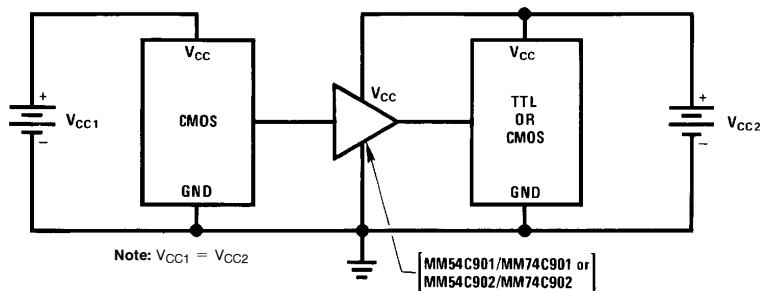
## Typical Applications

**PMOS to CMOS or TTL Interface**



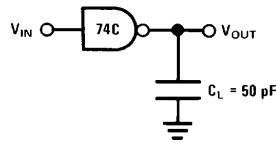
TL/F/5909-7

**CMOS to TTL or CMOS at a Lower Vcc**



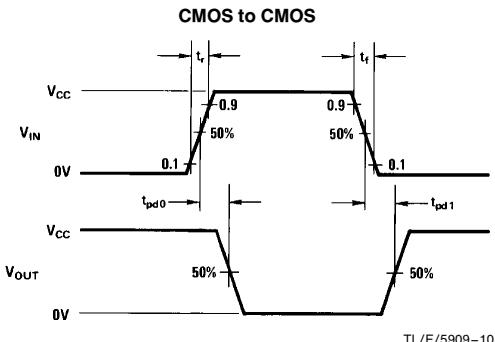
TL/F/5909-8

## AC Test Circuit and Switching Time Waveforms



TL/F/5909-9

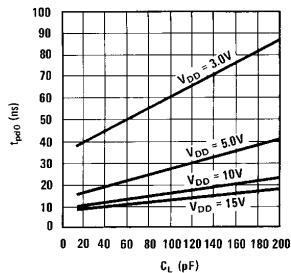
Note: Delays measured with input  $t_r$ ,  $t_f = 20 \text{ ns}$ .



TL/F/5909-10

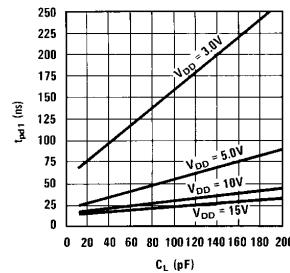
## Typical Performance Characteristics

Typical Propagation Delay to a Logical "0" for the MM54C901/MM74C901 and MM54C903/MM74C903



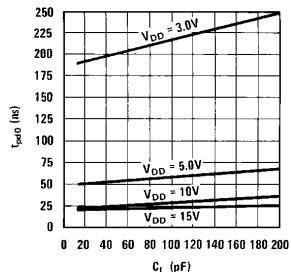
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Typical Propagation Delay to a Logical "1" for the MM54C901/MM74C901 and MM54C903/MM74C903



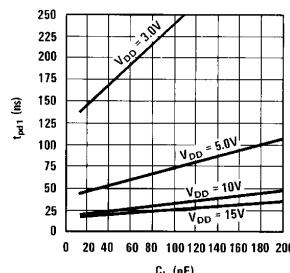
TL/F/5909-13

Typical Propagation Delay to a Logical "0" for the MM54C902/MM74C902 and MM54C904/MM74C904



TL/F/5909-14

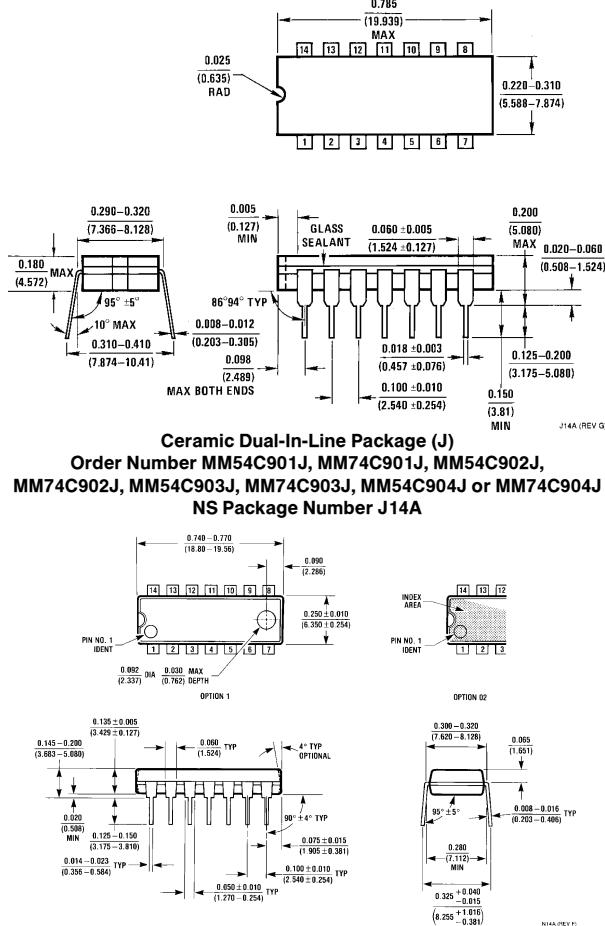
Typical Propagation Delay to a Logical "1" for the MM54C902/MM74C902 and MM54C904/MM74C904



TL/F/5909-12

# MM54C901/MM74C901 (TTL), MM54C903/MM74C903 (CMOS) Hex Inverting Buffer MM54C902/MM74C902 (TTL), MM54C904/MM74C904 (CMOS) Hex Non-Inverting Buffer

## Physical Dimensions inches (millimeters)



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